

Federal Motor Carrier Safety Administration

# Research & Technology

Annual Report 2001

Share the Road Safely

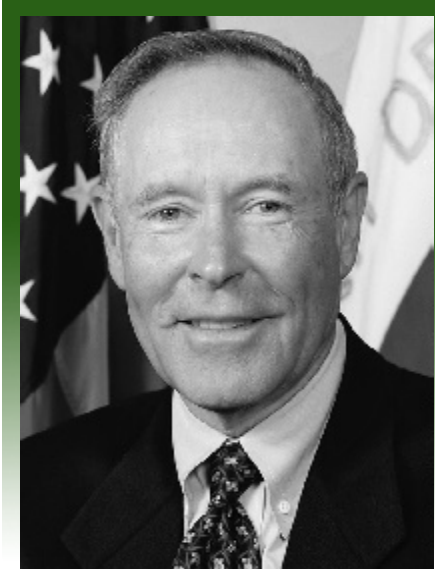


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## *A Message from the Administrator*

As the Federal Motor Carrier Safety Administration's Office of Research and Technology *Annual Report 2001* was being finalized, the events of September 11 turned the Nation's attention to transportation safety and



**Joseph M. Clapp**

*Administrator, Federal Motor  
Carrier Safety Administration*

drastically heightened our awareness of security issues. Ensuring the security of our transportation system for the movement of goods and people is a key element of the U.S. Department of Transportation's Strategic Plan. Now, more than ever, we need to realize this goal. We must be keenly aware of the need to protect the country's mobility by preventing and combating acts of terrorism.

Our *Annual Report 2001* emphasizes the safety applications of research and technology in commercial motor vehicle transportation. In the future, initiatives to identify and assess technologies and practices that contribute to counterterrorism will take on new importance. We will focus resources, as appropriate, on supporting and accelerating the national effort to ensure homeland security.

FMCSA's extensive knowledge base allows us to respond rapidly to any challenges. Based on our recent efforts to initiate security sensitivity visits and enlist the cooperation of our law enforcement partners in conducting thorough roadside inspections of commercial vehicles carrying hazardous materials, I know that we are equal to this task.

Defending the safety and security of commercial motor vehicle transportation is the mission before us. I promise the American people that, working with other Federal officials and State and local governments, we will do everything within our purview to accomplish this.

**Joseph M. Clapp**

## *A Message from the Acting Director of the Office of Research and Technology*

This annual report for the Federal Motor Carrier Safety Administration's Office of Research and Technology marks our first effort to catalog the



**Terry Shelton**

*Acting Director, Office of  
Research and Technology*

significant activities and accomplishments of our organization. Covering October 1, 2000 through September 30, 2001, this report provides a snapshot of our involvement with the motor carrier safety community, investment in both new and continuing research and technology, and advancement of initiatives to share the road safely.

Created on January 1, 2000, FMCSA is the newest U.S. Department of Transportation agency. We have experienced a time of great transition, a time of growth and development, of reorganizing and rethinking how we best can serve our Nation. We are a young agency—one in the process of evolution—poised to achieve our current target of reducing the number of fatalities resulting from crashes involving large trucks by 50 percent by 2010.

The direction upon which we have set out today has been chosen to lead us to tomorrow's improved safety on our Nation's highways. Through the application of solid research and advanced technology, we will steadily make our way.

**Terry Shelton**





# Overview

*Research is the discovery of new knowledge; technology is the development and application of new tools; increasing motor carrier safety requires both.*

This annual report provides a snapshot of the work performed by the Federal Motor Carrier Safety Administration's (FMCSA's) Office of Research and Technology during Fiscal Year 2001 (FY'01), which spans the period of October 1, 2000 through September 30, 2001. FMCSA was established as a new agency within the U.S. Department of Transportation on January 1, 2000. Formerly the Federal Highway Administration's Office of Motor Carriers (FHWA-OMC), FMCSA's mission is to improve truck and bus safety on U.S. highways. The Agency's top priority is to reduce the number of fatalities and injuries resulting from crashes involving large trucks by 50 percent by 2010. Meeting this goal will require many concerted and innovative motor carrier safety activities engaging government, the trucking industry, and—most importantly—drivers.

FMCSA's Office of Research and Technology (R&T) is responsible for planning, administering, coordinating, and managing Agency research and technology efforts to support FMCSA operational programs. Our work is aimed at gaining fundamental and applied knowledge and developing new methods and technologies to enhance truck and bus safety. The Agency has created a focused, dynamic motor carrier R&T Program to help achieve its safety goal. The program supports the diverse initiatives of the Agency relating to safety regulation, enforcement, and outreach—but also has a major thrust to deliver safety in new ways, in particular through the development, evaluation, and deployment of advanced safety technologies.



## The FMCSA Program Areas

Five distinct but interrelated program areas—Driver Safety Performance, Commercial Vehicle Safety Performance, Carrier Compliance and Safety, Safety Systems and Technologies, and Crosscutting Safety Initiatives—exist within R&T to support FMCSA's 2010 strategic objectives as noted below.

**Driver Safety Performance**—Ensure that commercial drivers are physically qualified and trained to operate commercial vehicles safely while staying mentally alert. Improve the safety behavior of noncommercial vehicle drivers in the vicinity of large trucks and motorcoaches. This program area includes four subareas:

- Commercial Driver Physical Qualifications
- Commercial Driver Training, Licensing, and Performance Enhancement
- Commercial Driver Fatigue
- Noncommercial Driver Behavior

Supports the following FMCSA 2010 strategic objectives: *All commercial motor vehicle drivers are fully qualified, safe, alert, and healthy, and improve the safety and performance of noncommercial drivers with respect to trucks.*

**Commercial Vehicle Safety Performance**—Improve truck and motorcoach performance through industry adoption of vehicle-based safety technologies. This program area includes the commercial vehicle platform of the Intelligent Vehicle Initiative funded by the U.S. Department of Transportation's (DOT) Joint Program Office for Intelligent Transportation Systems (ITS).

Supports the following FMCSA 2010 strategic objective: *Commercial motor vehicles have optimum safety performance.*

**Carrier Compliance and Safety**—Improve motor carrier compliance with Federal Motor Carrier Safety Regulations (FMCSRs) and their safety practices in general. This program area includes R&T projects designed to improve existing Agency safety interventions, such as compliance reviews of high-risk carriers. Also included are education and outreach efforts that enhance safety management practices not necessarily related to regulatory compliance, such as improved supervision of drivers and trip scheduling to reduce crash risk.

Supports the following FMCSA 2010 strategic objective: *Facilitate improvement in the overall safety performance of the motor carrier industry through refined and enhanced safety management systems.*

**Safety Systems and Technologies**—Identify, test, evaluate, and accelerate deployment of safety technologies and operational concepts that improve commercial motor vehicle (CMV) safety, and target high-risk carriers for enforcement and compliance actions. The ITS program also provides funds to support these activities.

Supports the following FMCSA 2010 strategic objective: *Develop a dynamic and focused motor carrier research and technology program.*

**Crosscutting Safety Initiatives**—Gain a deeper understanding of driver, carrier, vehicle, and roadway environment factors that place commercial motor vehicles at risk, and the potential applicability of countermeasures. Develop and foster R&T partnerships with other organizations in the motor carrier safety community, and enhance the management, effectiveness, and impact of the overall R&T Program.

Supports the following FMCSA 2010 strategic objective: *Develop a dynamic and focused motor carrier research and technology program.*



## The Safety Improvement Challenge

Commercial drivers must be medically fit, knowledgeable, alert, and able to operate vehicles and related equipment safely, efficiently, and comfortably. The R&T Program focuses on the performance of the CMV driver and also addresses safety performance issues relating to noncommercial drivers and their interactions with commercial motor vehicles. Since approximately 85 percent of fatalities involving commercial motor vehicles occur outside the truck to other vehicles and their occupants, CMV safety does not only concern the commercial driver, but also the entire public. The vast majority of these crashes are due to human error—either an error on the part of a noncommercial driver involved in the crash or of the commercial driver—or driver misbehavior.

*By 2010, it is envisioned that commercial trucks and buses will be equipped with an integrated set of technology applications that monitor the condition of the vehicle, driver, cargo, and roadway.*

While the driver is an integral component of motor carrier safety, the capabilities of the vehicle are also a critical element in the safety equation. Improving and deploying vehicle-based safety technologies—such as crash avoidance technologies, onboard data recorders, and occupant protection and safety devices—are required to reduce the most frequent types of crashes involving commercial vehicles. By 2010, it is envisioned that commercial trucks and buses will be equipped with an integrated set of technology applications that monitor the condition of the vehicle, driver, cargo, and roadway. Communications standards will be in place for protocols, onboard placement, driver interface, and roadway interface. These standards will enable widespread deployment of new and innovative systems. Vehicles will be capable of interfacing with highway facilities and key nodes on the freight system (ports, terminals, international border crossings, toll plazas, weigh stations, and other checkpoints) that use technologies and information to manage the flow of CMV traffic; help prevent and respond to crashes and other incidents; and focus enforcement resources on high-risk carriers, vehicles, drivers, and cargo. Current R&T projects are laying the groundwork needed to make this vision a reality.

Enforcing carrier compliance, researching changes to penalties to determine their impact on compliance, educating commercial drivers and carriers so that safety management is a foremost consideration—all of these elements help keep safe trucks and safe carrier practices on our Nation's roads. Comprehensive compliance with current regulations, however, must be enforced in ways that continue to keep America's motor carrier industry moving efficiently over our Nation's roads. Revenues for the motor carrier industry are a significant part of the national economy, representing approximately 5 percent of our gross domestic product. Unnecessary or

excessive delays at weigh stations can create a substantial economic impact. Using technological advances to target high-risk carriers and minimize carrier delays through the use of smart roadside facilities while performing vital compliance checks is paramount in today's economy. Integrating roadside and office-based systems with CMV onboard safety systems so that Safety Inspectors can check the safety status of motor carriers, vehicles, and drivers at highway speeds—or from their offices—is another important and attainable step toward increased safety and efficiency. Getting field-tested safety systems and technology deployed quickly, and accepted by commercial carriers and drivers, is another critical step toward the advancement of safety.

To achieve advances of this magnitude, however, we must perform the research that provides the basis to develop new technology and to apply that technology appropriately. Today's research and technology efforts are the foundation for tomorrow's advances and will guide the Nation to *share the road safely*.





# Driver Safety Performance

*Safe driving is a dynamic sensory-motor task requiring certain core physical abilities, training, and alertness.*

There are four major components of safe commercial driving. For commercial drivers to perform safely, they first must be physically and medically qualified for the job. Next, they must be trained in regard to critical job knowledge and skills. To exercise this knowledge and skill on the road, drivers must be rested and alert to properly control their own vehicles and to be able to drive defensively in traffic. A final component of commercial driving safety is noncommercial drivers—their driving performance and behavior in the vicinity of commercial vehicles also affects CMV safety. The Driver Safety Performance Program Area is divided into four distinct subtopics that directly respond to the four components of safe commercial driving. They are: Commercial Driver Physical Qualifications; Commercial Driver Training, Licensing, and Performance Enhancement; Commercial Driver Fatigue; and Noncommercial Driver Behavior. The application of research results in

these areas contributes to ensuring the safety of drivers and the motoring public.

The following descriptions highlight projects that are representative of both new starts and continuing work performed in FY'01 in this program area.

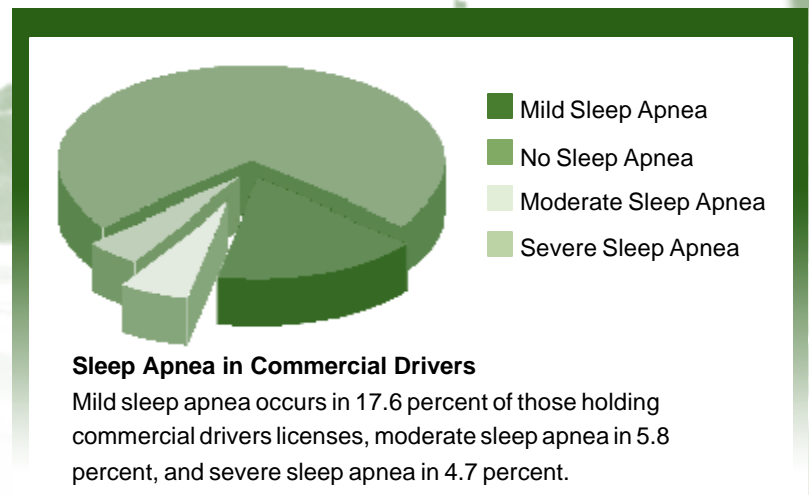
## **Goals**

- ensure that commercial drivers are physically qualified, trained to perform safely, and mentally alert
- improve the safety behavior of noncommercial drivers in the vicinity of trucks and buses

## Staying Awake Means Staying Alive

Sleep apnea is a major contributor to daytime drowsiness—a condition that may be embarrassing for workers holding a desk job but deadly for commercial drivers. FMCSA recently completed a project on the prevalence of sleep apnea among commercial drivers and found that sleep

apnea is a safety concern. The study documenting the findings of this project, which will be published in early 2002, identifies levels of functional impairment and cost-effective screening tools for individuals at risk for sleep apnea. In light of these findings, FMCSA has revised the medical examination form to require examination for sleep apnea during the biannual physical qualification examination. Planned work will develop a comprehensive education and outreach program for addressing sleep apnea.



**Contact:** Albert Alvarez  
**Products:** *A Study of Prevalence of Sleep Apnea Among Commercial Truck Drivers* (Report), 2002  
Tech Brief, 2002

## *Obesity is a major risk factor for sleep apnea and CMV drivers have high rates of obesity.*

### Driving Under the Influence of Diabetes

Is it safe, practical, and cost-effective to have a program that allows individuals with insulin-treated diabetes mellitus to operate a commercial motor vehicle in interstate commerce? This project is in response to that question, which was posed by Congress in Section 4018 of the Transportation Equity Act for the 21<sup>st</sup> Century (TEA-21). The R&T Program began a new phase of diabetes research in FY'01 to provide regulatory analysis support to new performance-based physical qualifications relating to diabetes. This project involved reviewing current scientific literature to compile and summarize recent findings on the performance effects of diabetes on both insulin-dependent and non-insulin-dependent drivers. Data collected in the diabetes exemption program will describe individual driver characteristics, driving and employment experience, and required medical information (such as the driver's disease history, present treatment, and experience with hypoglycemia in the past 5 years). After a driver has been accepted into the

diabetes exemption program, additional data (such as number of crashes and serious violations) will be collected through the Commercial Driver Licensing Information System (CDLIS) to monitor safe driving behavior. Monitoring data will be used to assess the safety performance of these drivers.

**Contact:** Sandra Zywokarte

**Products:** *A Report to Congress on the Feasibility of a Program to Qualify Individuals with Insulin-Treated Diabetes Mellitus to Operate Commercial Motor Vehicles in Interstate Commerce*, July 2000  
*Qualifying Individuals with Insulin-Treated Diabetes to Operate Commercial Motor Vehicles* (Tech Brief), November 2001

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## Tracking Positive Drug Tests

FMCSA is conducting a study of the feasibility and merits of requiring medical review officers and employers to report positive drug test results to the State that issued that specific driver's commercial driver's license (CDL). All prospective employers would be required, before hiring any driver, to query the State that issued the CDL on whether the State has any record of a verified positive drug test for that driver. This study is designed to examine the costs, benefits, and safety impacts of requiring States to maintain records of verified positive drug test results and to determine whether a process should be established to allow drivers to correct errors in their records and to expunge information from their records after a reasonable period of time. This project also is analyzing the:

- liabilities of implementing such a system
- possible methods to properly manage and monitor such a system
- means to correct, expunge, or modify database records of positive drug tests

**Contact:** Kaye Kirby

**Product:** *Drug Test Results Study* (Report), in press

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## Reviewing Existing Medical Qualification Regulations and Guidelines

In continuing research, medical review panels comprised of experts:

- review the regulations and guidelines under Part 391 of the FMCSRs, which sets forth minimum qualifications for CMV drivers, and makes recommendations for amending current Federal standards
- review and comment on the conduct and conclusions of FMCSA medical research, policy, and issues related to these standards

- prepare reports and reviews of outside publications, articles, research, and other documents related to these standards

**Contact:** Albert Alvarez  
**Product:** Review of standards and guidelines for cardiovascular diseases, early 2002

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## Defining Vision Exemption Program Improvements

Part 391 of the FMCSRs establishes minimum qualifications, including physical qualifications for persons who drive commercial motor vehicles as, for, or on behalf of motor carriers. FMCSA is responsible for the vision exemption program, which allows certain individuals who do not otherwise meet Federal physical requirements to operate commercial motor vehicles in interstate commerce. This project is conducting a workflow analysis of the vision exemption application process and an information flow analysis of the systems that support the exemption process. The goal is to identify potential efficiency improvements or fundamental process changes.

**Contact:** Albert Alvarez  
**Products:** Evaluation of exemptions granted, ongoing  
*Visual Requirements for Commercial Motor Vehicle Drivers* (Tech Brief), June 2001

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## Getting in Shape

Working with its industry partners, FMCSA has developed a multimedia-based driver wellness program that is being distributed to trucking fleets. The program is intended to encourage commercial drivers to make health-conscious behavior and lifestyle choices. In a cooperative agreement with the American Trucking Association's Trucking Research Institute, FMCSA will fund seminars and the dissemination of media and materials. This fatigue outreach program has been well received by the trucking industry and the public. The driver wellness program, also developed under the co-operative agreement, will continue with the dissemination of completed "Gettin' in Gear" program materials. Wellness sessions will be offered along with the fatigue outreach sessions, and the wellness course materials will be made available to the trucking industry via mail order.



**Contact:** Tony Schafer  
**Products:** "Gettin' in Gear" commercial driver wellness education package  
 Related educational seminars



## Exploring Biometrics to Detect License Fraud



Section 4011 of TEA-21 required that all commercial driver's licenses issued after January 1, 2001, include unique identifiers. Unique identifiers commonly used today are identification numbers, gender, height, and weight. In the future, unique biometric images such as a facial image or fingerprint also may be used. FMCSA is conducting this study to determine which combination of fingerprint and facial images can best be used to identify drivers and detect license fraud. In this pilot project, three States—Georgia, California, and West Virginia—are collecting sample facial images and fingerprints from volunteers. These electronically captured images are then stored to create a database of sample images. Searches of the entire database will be performed to find a single image (a one-to-many search), as well as searches comparing two images to find duplicate records (a one-to-one search). To test the ability of specialized matching software to detect fraudulent records, a set of random duplicate records will be added to the sample set. Fingerprint recognition is sophisticated enough to involve the comparison of minutiae. Facial imagery compares facial geometry such as the ridge angle between nose and face to find duplicate records. An additional goal of this project is to determine the optimum communication protocol to electronically exchange fingerprint images between States and to determine what level of image quality is sufficient to meet States' needs. This project will culminate in a final report that describes study findings.

**Contact:** Ron Finn

**Product:** *Development of Testing of Unique Identifiers for the CDL Program (Report), 2002*

## CMV DRIVER FACTS & STATS

CMV drivers may drive up to 10 hours continuously before taking a break, often drive at night, and sometimes have irregular and unpredictable work schedules. Much of their mileage is compiled during long trips on interstate and other four-lane roadways. Because of their far greater mileage exposure and other factors, the risk of commercial drivers being involved in a fatigue-related crash is far greater than that of noncommercial drivers—even though CMV drivers represent only about 4 percent of the drivers involved in known fatigue-related crashes and their rate of involvement per mile traveled is no greater than that of noncommercial drivers. In addition, other crash factors such as alcohol, speeding, and other unsafe driving acts are less common among commercial drivers and thus, are less important *relative* to fatigue. FMCSA's constituency, including the public, highway safety advocates, the CMV industry, and researchers, has identified driver fatigue as a top-priority CMV safety issue. FMCSA supports this designation and has allocated its resources accordingly.

## Defining the Relationship Between Pay Practices and Safety

This empirical study is assessing the relationship between driver pay and safety to determine if payment by the mile encourages truckers to drive unreasonable hours or exhibit unsafe driving practices that could increase the risk of crashes. While anecdotal evidence abounds, this will be the first study to provide reliable, methodically sophisticated research of this issue. This study has used data from a variety of sources, including a large roadside survey of drivers; a comprehensive survey of pay practices of more than 400 large carriers; information gathered from detailed audits of various large companies; and exhaustive pay, crash, and demographic data from one large truckload carrier prior to and following a large pay raise. Approximately 1,000 drivers participated in the roadside surveys, which consisted of detailed 45-minute interviews or briefer, 5-minute fuel line surveys. Participants were asked general demographic questions, as well as specific questions about their health, finances, safety, and employment history. Phase 1 of this project, which consisted of a literature review and work plan, is complete. The data collection efforts of Phase 2 are complete and data analysis is currently underway. The project will culminate with a final report providing findings.

**Contact:** Chuck Rombro  
**Product:** *Impact of Pay Practices on Commercial Truck Driver Safety* (Report), in press

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## Developing a Truck Driver Assessment Tool

The driver assessment tool project is the first of many FMCSA-sponsored technology studies contracted through the DOT Small Business Innovation Research (SBIR) program. The SBIR program, mandated by Congress, serves to stimulate technological innovation, provide opportunities to small businesses to meet the Federal government's R&T needs, increase private sector commercialization of Federal R&T innovations, and provide opportunities for minority and disadvantaged businesses to participate in technological innovation. SBIR projects may relate to any FMCSA R&T area, provided they demonstrate the potential to reduce CMV crashes.

The driver assessment tool project will investigate the feasibility and validity of an efficient, low-cost, portable assessment tool to measure basic cognitive skills and behaviors drivers need to safely operate commercial motor vehicles. One potential approach is the use of a PC-based simulation that could provide drivers with traffic situations calling for safe vehicle control, defensive driving, crash threat recognition and reaction, decisionmaking, and execution of evasive maneuvers. Such a tool would help assess and predict driver performance and safety.

**Contact:** Jerry Robin  
**Product:** Prototype of the truck driver assessment tool, 2002

## Keeping Good Drivers

Does a high rate of retention reflect better selection of drivers, or is there demonstrable improvement of safety for individual drivers associated with familiarity with a particular job, route, and work pattern? Recent studies have documented a clear relationship between driver retention in a fleet and driver safety, but the cause of this relationship remains undetermined. Driver turnover rates of 100 percent are common in for-hire trucking, especially in the long-haul truckload segment of the industry. Typically, fleets with low driver turnover rates are characterized by high safety standards and performance. This study, which provides a preliminary step in addressing driver retention issues and impact, is aimed at determining if one avenue to improved driver and fleet safety is improved retention. Also being reviewed is the literature linking driver retention and safety and summarizing effective carrier practices to improve driver retention. Information gathered will be disseminated to the trucking industry and will support FMCSA safety outreach programs such as "Safety is Good Business."

**Contact:** Albert Alvarez

**Product:** *Driver Retention and Safety* (Report), 2002

## Improving Driver Training

Section 1212(k) of TEA-21 states, in part, "...the Secretary shall make grants to establish a driver training and safety center at Connellsville, Pennsylvania. The purpose of the facility shall be to train and enhance the driving skills of motor vehicle and emergency vehicle operators." In accordance with congressional intent, a 3-year cooperative agreement was awarded to the Carnegie Mellon Driver Training and Safety Institute (CMDTSI). The Highway Trust Fund, as a provision of TEA-21, funded CMDTSI, which is providing novice truck driver training, advanced truck driver training, and driver training for emergency vehicle operators. In addition to driver training, this state-of-the-art facility conducts training-related research employing driving simulation technology, in-vehicle driving evaluation recording technology, and a custom-designed skid pad. As of November 2001, approximately 210 students have completed the CMDTSI program.

## CALCULATING THE BENEFITS OF INCREASED TRUCK SAFETY

Commercial drivers are generally good drivers. Per mile traveled, combination-unit drivers have a crash involvement rate that is less than one-half that of noncommercial drivers. However, because of the high mileage exposure of trucks and the often severe consequences of their crashes, there is a premium on making trucks and truck drivers safer.



The CMDTSI also sponsored an international conference, which is discussed under “Staying Current,” later in this report.

**Contact:** Jerry Robin

**Products:** *Driver Traits and Performance Characteristics* (Report), 2002  
*Technology Intensive vs. Non-Intensive Training* (Report), 2002

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## Determining the Effects of Sleeper Berth Use

This real-world study sought to determine the effects of sleeper berth use on driver alertness and driver performance. Researchers examined the quantity and quality of sleep for single drivers and teams that used sleeper berths. Sleep quality and quantity were measured using a portable electroencephalograph (EEG) to measure brain activity (a proven indicator of sleep quality). The trucks also were equipped with a system of video cameras that recorded the driver's face and the environment around the truck, including other proximal vehicles. Additionally, the trucks were fitted with multiple sensors that would trigger the video system to record when a critical incident occurred, such as hard steering, rapid deceleration, or closing too fast on the lead vehicle.

**Contact:** Bob Carroll

**Product:** *Impact of Sleeper Berth Usage on Driver Fatigue* (Report), January 2002

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## Fighting Fatigue with Technology

This pilot test is demonstrating the use of fatigue-related technologies to enhance CMV driver fatigue management within current hours-of-service rules. As a cooperative FMCSA–Transport Canada study, with involvement of both FMCSA R&T and the Intelligent Vehicle Initiative (IVI) Commercial



### The PERCLOS Monitor

The monitor measures driver alertness by using electro-optical technologies to monitor eye movements, even in low-light conditions.

Vehicle Platform, the pilot test combines driver alertness monitoring (using the eyelid droop measure known as PERCLOS, meaning PERcent of eyelid CLOSure) with other fatigue management technologies. These other technologies include sleep history monitoring accomplished through use of an actigraph and sleep–wakefulness models, a lane-tracking device (SafeTRAC), and the Howard Powered Center Steering System. The actigraph, PERCLOS monitor, and lane tracker will all provide direct feedback to drivers on their amounts of sleep, readiness, “eyes open” alertness, and lane-keeping performance. Numerous research studies sponsored by DOT and others have provided proof of concept for the validity of the various alertness/performance measurements employed. These technologies are now ready to progress from laboratory and experimental use to use as fatigue management aids



in an operational “alpha test.” Field data collection on the use of these technologies as aids to driver fatigue management is beginning in early FY’02.

**Contact:** Bob Carroll  
**Product:** Report, 2003

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### Studying Motorcoach Driver Fatigue

FMCSA is performing a study on motorcoach driver fatigue, with an emphasis on scheduling and hours-of-service implications. The need for this study was recently verified by comments to the docket and during all three rulemaking hours-of-service roundtable discussions, which repeatedly stated the need to look at motorcoach drivers and long-haul truck drivers separately. Two major factors distinguish bus drivers from truck drivers—unlike their truck-driving counterparts, motorcoach drivers often do not set their own schedules but can rest only when allowed by the tour operator and, while driving, they have constant customer contact. Since different environmental factors are likely to create different fatigue characteristics and require different fatigue mitigation measures, this study is designed to look at fatigue as specifically experienced by motorcoach operators.

**Contact:** Peter Chandler  
**Product:** Report, 2002  
**New Start**

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### Educating the Driving Public

Recognizing the need to use new tools to achieve its safety objectives, FMCSA is continuing to review and expand its “Share the Road Safely” Program. Through education and enforcement pilots, FMCSA is developing innovative approaches to educate the motoring public about its role in motor carrier safety, combined with the enforcement of existing and new traffic laws. The program’s objective is to minimize the risk of crashes involving cars and large trucks. Pilot projects will be conducted in two or more States and expanded as appropriate. Strategies that produce results in the pilots will be promoted throughout the Nation.

**Contact:** Jim Keenan  
**Product:** Nationwide promotion of education and enforcement strategies to reduce car–truck crashes



## Educating Mature Drivers

FMCSA is using the “Share the Road Safely” Program to address the impact an aging population has on motor carrier safety improvement initiatives. The Agency is developing outreach materials with “Share the Road” messages and health and wellness advice appropriate for mature drivers, because driving skills deteriorate as drivers age. These outreach strategies will target specific audiences and their effectiveness will be assessed in a local community. The project will result in a comprehensive mature-driver outreach strategy that can be replicated in localities across the Nation.

**Contact:** Jim Keenan  
**Product:** Comprehensive mature-driver outreach strategy  
**New Start:** Contract awarded

*The drivers of cars and other small vehicles may be unaware of the operational limitations of trucks and buses, such as maneuverability, blind spots, and stopping distances.*

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## Validating Simulator Use

This research will empirically validate a low- to mid-cost truck driving simulator for commercial driver training. Situation-specific and general training simulators have been successfully employed for many years by the aviation and defense industries. A primary objective of this study is to examine how simulation-based training, as compared to conventional training methods, can enhance the training environment and improve tractor-trailer driver performance. The study is being conducted in two phases. Phase 1, which has been completed, was the development of the research design. Phase 2 involves conducting a 3-year empirical validation study employing the Phase 1 research design. The result of Phase 2 will be a report cataloging the simulator functional criteria necessary to perform the empirical study and assess the capabilities of several available truck simulators. The procurement for the actual simulator validation (SimVal) study will commence in FY'02.

**Contact:** Jerry Robin  
**Products:** *Truck Simulator Reassessment Final Report, 2002*  
*Validation of Simulator Technology in the Training, Testing, and Licensing of Tractor-Trailer Drivers (Tech Brief), February 2000*



# Commercial Vehicle Safety Performance

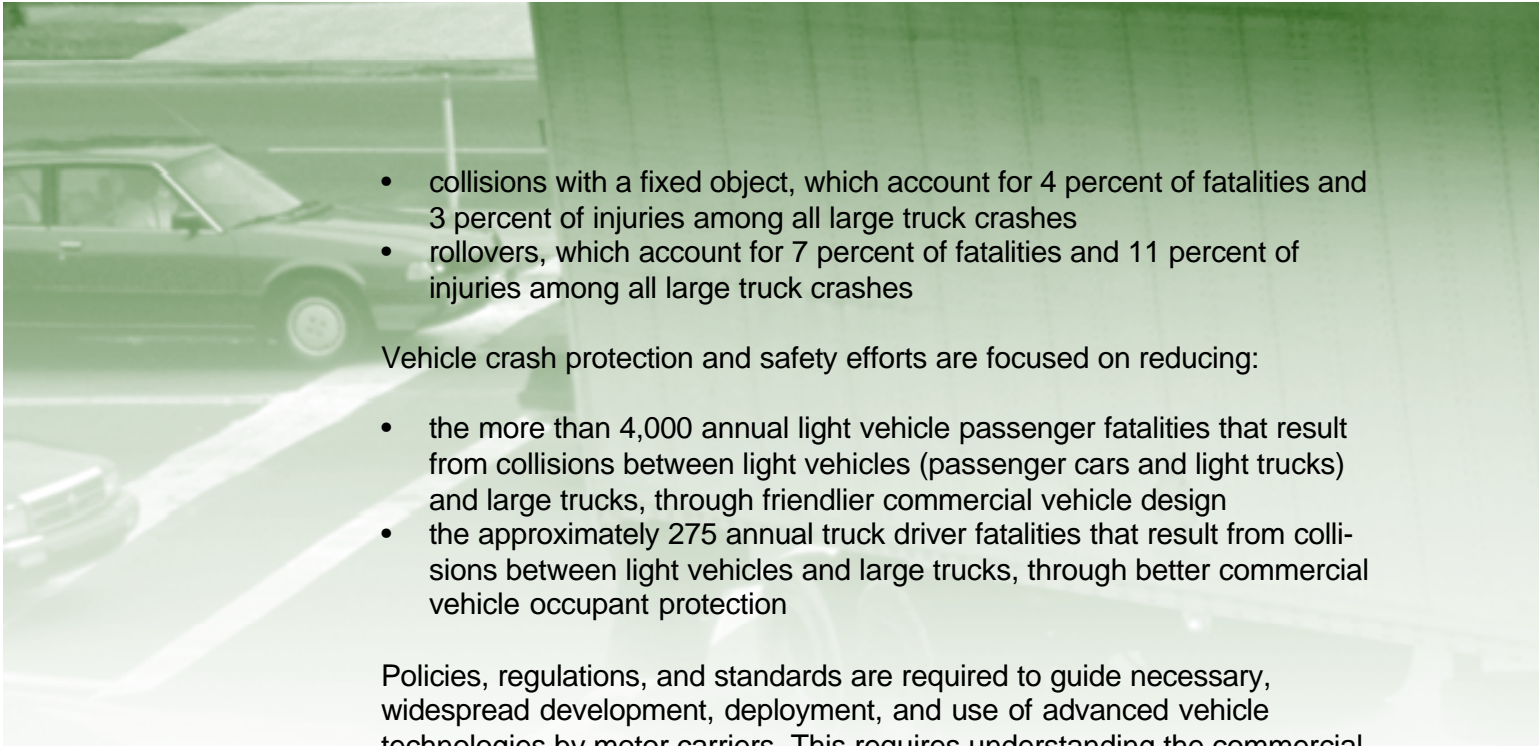
*Pursuing these initiatives will result in a significant percentage of commercial vehicles equipped with advanced safety technologies by 2010.*

The Commercial Vehicle Safety Performance Program Area concentrates on improving vehicle safety and providing systems on vehicles to facilitate safe driving performance. The program consists of initiatives aimed at deploying new intelligent vehicle safety technologies, improving occupant protection and safety, and developing new policies and standards to promote the deployment of vehicle technologies that enhance safety.

Work in the area of intelligent vehicle safety technologies aims to reduce harmful events, such as:

## **Goal**

- improve truck and bus performance through vehicle-based safety technologies
- collisions between a truck and another vehicle, which account for 80 percent of fatalities and 79 percent of injuries among all large truck crashes

- 
- collisions with a fixed object, which account for 4 percent of fatalities and 3 percent of injuries among all large truck crashes
  - rollovers, which account for 7 percent of fatalities and 11 percent of injuries among all large truck crashes

Vehicle crash protection and safety efforts are focused on reducing:

- the more than 4,000 annual light vehicle passenger fatalities that result from collisions between light vehicles (passenger cars and light trucks) and large trucks, through friendlier commercial vehicle design
- the approximately 275 annual truck driver fatalities that result from collisions between light vehicles and large trucks, through better commercial vehicle occupant protection

Policies, regulations, and standards are required to guide necessary, widespread development, deployment, and use of advanced vehicle technologies by motor carriers. This requires understanding the commercial vehicle of the future and developing timely and appropriate policies, regulations, and standards.

Through these initiatives and working with the industry, a smart commercial vehicle will be produced by 2010 that will include proven, cost-effective forward and rear collision avoidance technologies, rollover prevention technologies, improved vehicle stability and safety through electronic braking systems, advanced sensor systems for diagnostic monitoring of safety-critical components such as brakes and tires, and improved vehicle design features to increase occupant safety and reduce vehicle-to-vehicle crash severity. Pursuing initiatives in the three subtopic areas of the Commercial Vehicle Safety Performance Program Area will result in a significant percentage of commercial vehicles equipped with advanced safety technologies by 2010.

The following descriptions highlight projects that are representative of both new starts and continuing work performed in FY'01 in this program area.

## *More than 50 percent of the fatalities of tractor-trailer drivers occur in rollovers.*

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### Accelerating the Deployment of New Technology

While IVI field operational tests are underway on several different safety technologies for use on board commercial motor vehicles, FMCSA is looking ahead to accelerating the deployment of these technologies. The successful and widespread deployment of these safety technologies on commercial motor vehicles is critically important to improving highway safety and meeting the FMCSA goal of reducing fatalities and injuries by 50 percent by 2010.





This project is developing deployment plans to promote the use of the following crash avoidance technologies:

- Forward Collision Warning System with Adaptive Cruise Control
- Rollover Stability Advisor and Rollover Stability Controller
- Lane Departure Warning Device

Each of these plans will identify: potential users (especially high-risk companies and drivers); factors that are important in making decisions to manufacture, purchase, and use onboard safety technology; costs and benefits; effective ways to reach users; efforts to accelerate deployment; barriers to deployment and recommended solutions; incentives for deployment; potential private–public partnerships; and multiyear strategies to increase awareness and accelerate deployment of onboard safety technology to reduce fatalities and injuries related to commercial motor vehicles.

**Contact:** Amy Houser

**Products:** Deployment plans for rollover stability advisor and rollover stability controller, 2002

Forward collision warning system with adaptive cruise control, 2002

Lane departure warning device, 2003

**New Start**

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### Developing Guidelines to Replace Expensive Analysis Methods

Preventing the release of hazardous materials carried in cargo tanks on our Nation's roads is an important FMCSA concern. Currently, FMCSA guidelines and analysis procedures employ mathematical formulas to determine the amount of stress and allowable loads that can be exerted on a cargo tank or its protection devices without causing permanent deformation and damage resulting in the release of hazardous material. Determining how much the tank can be distorted before its integrity is compromised—known as plastic finite element analysis—poses a difficult, time consuming, and costly task. By developing damage tolerance guidelines, FMCSA hopes to significantly decrease the need to perform plastic analysis. The guidelines will identify the point at which accident protection devices fail, compromising the integrity of the tank and resulting in a safety emergency. This information will be marketed to the Truck Trailer Manufacturer's Association and the Cargo Tank Manufacturer's Association in FY'03, so their members will be better equipped to design and build safer cargo tanks.

**Contact:** Dan Shelton

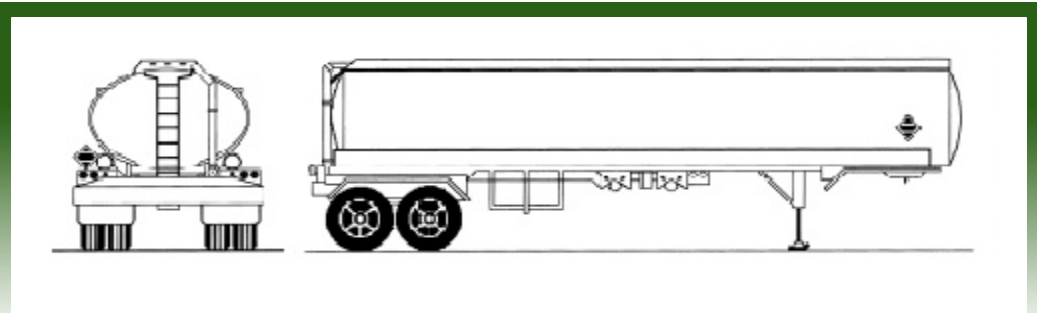
**Product:** Cargo tank damage tolerance guidelines, FY'03

**New Start**

## Verifying Simulation Accuracy

This project provides empirical verification of a previously completed analysis that used a modified version of the TRUCKSIM computer simulation modeling program to depict the forces acting on cargo tank overturn protection devices. To accomplish this goal, researchers will equip a cargo tank or cargo tank model with gauges to measure the forces and/or energy involved in a rollover. Physical testing will be used to verify the results from TRUCKSIM. Verifying the accuracy of the previous study's conclusions is important because DOT is considering using this information as the basis for revising the hazardous materials regulatory requirements for cargo tank rollover protection devices. The current study is also in response to National Transportation Safety Board (NTSB) recommendations that FMCSA model and analyze rollover forces. When completed, the study will be documented in a final report describing procedures and test results, which will be correlated with the results of the computer simulation model to verify its accuracy in predicting the forces and energy involved in cargo tank rollover crashes.

**Contact:** Dan Shelton  
**Product:** Report, 2002  
**New Start**



*Stops, turns, and other maneuvers make the liquid in cargo tanks shift rapidly, often causing a dramatic shift in weight and force distribution. A cargo tank's high center of gravity also contributes to instability.*

## Enhancing Driver Visibility

*The No-Zone*, which is comprised of those blind spots around trucks that are large enough to hide automobiles and other vehicles, places dangerous limitations upon the CMV driver's ability to see other vehicles. Providing better side or rear visibility *reduces* blind spots—providing proper mirror alignment can *eliminate* blind spots in trucks and buses. During FY'01, FMCSA collaborated with the National Highway Transportation Safety Administration (NHTSA) to initiate a study of CMV driver mirror use and

effectiveness. This study reviews and documents currently available truck mirror designs, noting the most common mirror types in use, and examining CMV mirror adjustments at truck stops. The study addresses whether drivers have mirrors properly adjusted and installed on the appropriate tractor trailer configuration. This effort will result in recommended practices for equipping trucks and buses with mirrors, proper mirror adjustment, and proper mirror use.

**Don't hang out in the  
NO-ZONE™**

**Contact:** Zeborah English  
**Product:** Video and training module, 2003

## Exploring Onboard Data Systems

There are an increasing number of sensors and systems on board commercial motor vehicles. These systems can improve both safety and productivity by providing data to:

- drivers, to provide feedback and warnings on their performance
- carriers, to monitor and manage driver safety performance
- crash reconstructionists, to evaluate crash factors
- roadside inspectors, to expedite safety inspections
- carriers, to improve vehicle maintenance

This project is identifying onboard vehicle safety applications and documenting major efforts and studies related to these applications. The project will be completed in FY'02, followed by a possible pilot test in FY'03 and the potential development of a voluntary standard for an in-vehicle data system.

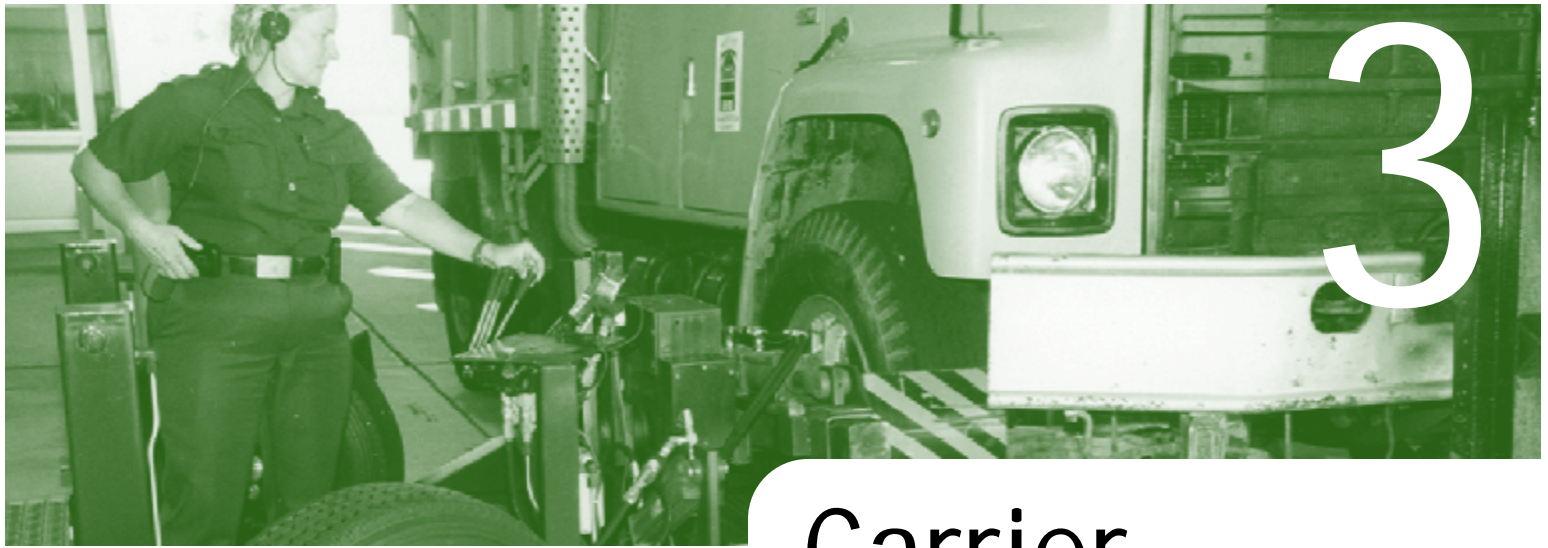
**Contact:** Amy Houser  
**Product:** Crosscutting study of onboard data systems, 2002

**New Start**

## ADDRESSING CMV LANE CHANGE AND BACKING CRASHES

By far, the areas of greatest CMV involvement in crashes are backing, lane changes, and merge crashes (e.g., lane changes into blind zones). While large trucks account for approximately 4 percent of all vehicle crash involvements, they account for 10 percent of the "at-fault" vehicles in lane change and backing crashes. Proper mirror adjustment is critical to the reduction of blind spots. Although numerous innovative and effective CMV mirror designs are available, they are not marketed throughout the entire carrier community (i.e., medium- and small-sized carriers).





# Carrier Compliance and Safety

*Agency enforcement activities revolve primarily around the compliance review process.*

The Carrier Compliance and Safety Program Area supports FMCSA's important objective of improving safety through regulatory compliance. By improving the regulatory compliance of motor carriers—especially high-risk carriers—vital safety checks are kept in place. These enforcement efforts are directed primarily toward the industry's worst offenders and are fundamental elements of the Agency's safety strategy. The Draft Agency Strategic Plan

also emphasizes nonenforcement-related initiatives—efforts to facilitate improvement in the overall safety performance of the motor carrier industry through refined and enhanced safety management systems.

The Carrier Compliance and Safety Program Area seeks to upgrade all aspects of motor carrier fleet safety management. Of course, the Federal role is first to enforce FMCSRs relevant to carriers.

## **Goals**

- improve enforcement of carrier-related Federal Motor Carrier Safety Regulations
- apply safety management science principles to improve carrier safety
- compile and communicate cross-industry best management practices to motor carrier managers
- reduce human and environmental exposure to hazardous materials caused by commercial trucks



Agency enforcement activities revolve primarily around the compliance review (CR) process in which Agency investigators perform audits of identified high-risk or problem carriers for the purpose of assessing their compliance with the FMCSRs. Outreach efforts such as “Safety is Good Business” also serve as important educational tools and safety reminders for commercial drivers.

The Carrier Compliance and Safety Program Area performs studies to:

- assess the trucking industry operational characteristics and related carrier safety performance
- develop approaches to improving carrier compliance with FMCSRs
- facilitate improvement in the overall safety performance of motor carriers through the application of safety management systems

The following descriptions highlight projects that are representative of both new starts and continuing work performed in FY’01 in this program area.

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## Tracking and Monitoring Hazardous Packages

To improve the tracking and monitoring of hazardous material shippers and carriers, this FMCSA project is designing and developing a software program to allow field investigators to record the results of hazardous material package inspections. As an experimental redesign of the Hazardous Materials Package Inspection Program (HMP/IP), the new HMP/IP-2 is designed as a Web-based data collection system.

HMP/IP-2 is unique in that it can run in two modes—it can be called up on the

Web (using virtual private network encryption) as a normal browser-based client-server application or it can operate without a Web connection by using the local computer as both browser and Web server. This second approach, called “persistent browser technology,” allows the user to enter data regardless of the status of the Web communication link. Upon later Web connection, the application transfers data and can update itself to ensure full synchronization between the two modes. HMP/IP-2 is the first piece of software to be developed by FMCSA as a Web-based tool. This product will be monitored to determine if Web-centric technology is ready for deployment in FMCSA field applications.



**Contact:** William Quade  
**Product:** HMP/IP-2 Web-centric software  
**New Start**



## Improving the Compliance Review Process

The CR process is the primary method used by FMCSA to determine carrier compliance with the FMCSRs. This FY'01 start is aimed at performing a comprehensive process review analysis and evaluation of the CR, including regulations, procedures, information sources, and policies, as well as potential new operational methods. This review also will develop new procedures and enhanced practices to streamline the CR process and improve the safety impact of CRs. The project will consider innovative approaches for an alternative operation system. The result will be documentation on the existing process, revised programs and policies, and revised Safety Investigator training.

**Contact:** Dale Sienicki and Bob Proferes

**Products:** New procedures manual and Safety Investigator training to improve the safety impact of CRs

Interim report on the current process, 2002

**New Start**

*The compliance review process is the primary method used by FMCSA to determine carrier compliance with the Federal Motor Carrier Safety Regulations.*

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## Evaluating the Effectiveness of Stricter Penalties

Section 222(d) of the Motor Carrier Safety Improvement Act of 1999 (MCSIA) requires FMCSA to produce a report to Congress on the effectiveness of its newly revised and increased civil penalties. In response, FMCSA is comparing the overall state of compliance before and after implementation of the higher penalties authorized by TEA-21 and MCSIA, and studying the post-enforcement compliance behavior of carriers subjected to enforcement and civil penalties. This effort is planned to take place in three stages: 1) tracking the legislative history of penalties revised by TEA-21 and MCSIA and determining the study scope; 2) developing an analysis plan to measure effectiveness; and 3) implementing the analysis plan and preparing the report. Work in 2002 through 2004 will evaluate the effectiveness of FMCSA's implementation of the MCSIA Section 206 sanctions against motor carriers, brokers, and freight forwarders who fail to pay civil penalties.

**Contact:** Dale Sienicki

**Product:** Report to Congress, due by September 30, 2002

**New Start**



## Reaching Out to Promote Safe Practices

The objective of FMCSA's "Safety Is Good Business" Program is to provide small motor carriers, drivers, and shippers with the information resources they need to promote safe operations and reduce commercial vehicle and passenger car crashes. The focus of this program is to create a companywide culture of crash avoidance by changing both driver and operational behaviors within an organization.

The core of the program will be a comprehensive tool kit of best practices for companies to use in designing, implementing, and evaluating safety programs within their organizations as well as their extended communities. This resource will be distributed through a variety of means, including a Web site that will create an on-line community of organizations and individuals committed to growing and improving the program. This initiative also will include a support coalition of trucking, motorcoach, association, insurance, manufacturing, and other representatives.

**Contact:** Tony Schafer

**Product:** Establishment of a tool kit for companies; support coalition of trucking-related groups; and other elements to help motor carriers, drivers, and shippers promote safety and reduce crashes

**New Start:** Contract awarded

## REDUCING CRASHES BY IMPROVING REGULATORY COMPLIANCE

Improving safety means improving compliance with, and enforcement of, existing FMCSRs. To further this effort, studies of roadside inspection criteria and procedures, compliance reviews, application of sanctions and penalties, and development of systems to facilitate compliance and enforcement are essential. Assessment, design, and development of new motor carrier safety data systems supports prioritization of drivers/vehicles for roadside inspection and carriers for compliance reviews and other enforcement actions. These activities improve FMCSR compliance; in particular, they improve compliance with regulations related to vehicle mechanical condition and driver hours of service.

# Safety Systems and Technologies

*By 2010, onboard and roadside safety technologies and concepts that target high-risk motor carriers will help reduce the frequency and severity of truck and bus crashes.*

By advancing the development and deployment of rapidly changing technology and implementing new operational concepts, the Safety Systems and Technologies Program Area is helping FMCSA meet the safety goal of reducing the number of CMV fatalities and injuries by 50 percent by 2010. "Business as usual" will not work to achieve this goal. The 1999 crash data show that 78 percent of all fatal crashes involving large trucks are collisions between large trucks and other vehicles. New onboard and roadside safety

technologies and concepts, combined with targeting high-risk motor carriers will help reduce the frequency and severity of these types of crashes.

FMCSA has identified two key projects in the Safety Systems and Technologies Program Area that explore these new technologies and concepts.

## Goals

- identify, test, evaluate, and deploy new technologies and operational concepts that improve CMV safety
- target high-risk carriers for enforcement and compliance actions



- The Safety Technologies for 2010 Project supports accelerated research, testing, and technology transfer of new safety technologies and operational concepts.
- The Commercial Vehicle Information Systems and Networks (CVISN) Deployment Project supports electronic exchange of safety and other information among States, the motor carrier industry, and the FMCSA to improve the targeting of high-risk and uninspected truck and motorcoach operators.

Through the CVISN Deployment Project, Federal and State government agencies work together with the motor carrier industry to develop and deploy cost-effective information systems and communication networks that provide electronic access to timely and accurate motor carrier safety and other information. CVISN is not an information system, but is the collection of information systems and communication networks that together provide a framework for States, the Federal government, and private stakeholders to electronically collect, process, and exchange motor carrier safety information and CMV and driver data. CVISN helps Federal and State enforcement officials target high-risk motor carriers for enforcement and compliance actions and identify high-risk or previously uninspected commercial motor vehicles and drivers for further inspection. State government agencies are providing more efficient and responsive administrative processes for their motor carrier industry customers. Safe and legal carriers are moving freight more efficiently, as safety enforcement efforts are focused on high-risk carriers, commercial motor vehicles, and drivers.

Working in concert with the DOT's Intelligent Transportation Systems/ Commercial Vehicle Operations (ITS/CVO) Program, FMCSA R&T projects will accelerate the testing of technologies, technology transfer, rapid deployment of new technologies, continued deployment of CVISN capabilities, and expansion of CVISN concept development.

The following descriptions highlight projects that are representative of both new starts and continuing work performed in FY'01 in this program area.

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### Improving Safety Investments

FMCSA is assessing several decision-support computer models to evaluate the expected safety benefits and economic impact of proposed regulatory initiatives, new enforcement strategies, technological advances and incentive programs on CMV and driver safety. In a two-part effort, FMCSA will complete a feasibility study of existing models in FY'02. If a model meets the needs of FMCSA and State safety agencies, the second part of the project—implementation—will begin later in FY'02. The selected model will be designed to incorporate new truck crash causation knowledge and crash data

obtained through improved Federal and State safety information systems. Once implemented, the decision-support computer model will be used by FMCSA and State safety agencies to help make more informed investment choices that maximize public sector resources to reduce fatalities and injuries from truck and bus crashes.

**Contact:** Jeff Loftus  
**Product:** Decision model feasibility study results, 2002  
**New Start**

## HOW MUCH IMPROVEMENT AND HOW MUCH SAVINGS?

If CVISN deployment results in enhanced safety for drivers, trucks, and buses, and greater operating efficiencies for electronically linked government agencies and motor carriers, what type of savings in time, resources, and the cost of doing business will both the public and private sectors realize? What type of safety improvements are anticipated? Initial estimates reveal:

### Savings

- A study by the Texas Transportation Institute estimated that it costs between \$50 and \$70 per hour to operate a commercial motor vehicle. Every minute a commercial vehicle is stopped at a weigh/inspection station takes at least \$1 from the average fleet's bottom line.
- An eight-State case study sponsored by the National Governors' Association consistently showed positive benefit-to-cost ratios of up to 6:1 for administering motor carrier credentials electronically. In addition, an American Trucking Associations' Foundation study of 700 medium- and large-sized motor carriers showed an expected benefit-to-cost ratio of 4:1 and 19:1, respectively.
- The State of Washington estimates that by 2008, the combined total of benefits of CVISN Level 1 deployment to the taxpayers and truckers of the State is projected to be between \$26.7 and \$53.1 million.
- ITS/CVO technologies are predicted to deter tax evasion, which could save an estimated \$500,000 to \$1.8 million per State.

### Safety Improvements

- In a study of 40,000 inspections, Safety Inspectors increased the number of unsafe commercial drivers and vehicles removed from the highway from 8,000 to 12,000 by using advanced safety information systems instead of traditional methods.
- Improvement in safety data quality and transfer time through electronic data interchange (EDI) vastly improves safety monitoring. Roadside inspectors receive more current, timely information.
- The ability to identify hazardous cargo on vehicles involved in crashes can reduce the risk of loss of life to those involved in the crash, the emergency response team, and the people living and working near the crash scene by reducing the time needed to properly handle the material.

## Investigating Promising Technologies

Maintaining position in a highway lane during nighttime driving conditions can be a challenge for CMV drivers. Rollovers and other types of crashes may result when a driver quickly applies steering control to bring a vehicle back into its lane. The primary objective of this project is to determine if a laser-guided device can improve heavy vehicle stability and control by improving the driver's ability to stay in lane. On-road tests will be performed in FY'02 using a vehicle equipped with a laser guidance system on a section of Interstate 81 with relatively low traffic volume. Commercial drivers who have not previously used a laser guidance system will participate in the study. Consisting of two fixed, low-power lasers mounted on each side of a heavy vehicle and directed to strike the pavement 15 feet (4.6 m) in front of the vehicle at points aligned with the vehicle's sides, the laser guidance system provides a pointing device to aid nighttime driving. Tests conducted will determine if this system shows promise in reducing commercial driver workload and improving nighttime directional control.

**Contact:** Tim Johnson

**Product:** Final report and presentation of study results, FY'02

**New Start**

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## Quantifying the Safety Benefits of CVISN Deployment

CVISN provides State roadside enforcement officials with nearly instant access to a variety of safety information on individual carriers and vehicles. This project will result in a plan for FMCSA to use to quantify the benefits of CVISN as currently deployed in several locations, identify the gaps exhibited in current data gathering, and suggest ways of filling these gaps. The final plan produced by this project, which will include either a data collection plan or statistical models to estimate the direct and indirect safety impact of individual CVISN components (such as safety information exchange, electronic screening, and electronic credentialing), as well as the combined impact of multiple components, will aid States in making decisions regarding CVISN deployment.



**Contact:** Jeff Secrist

**Products:** Tech Brief, 2002

FMCSA plan for evaluating the overall safety impact of CVISN deployment, 2003

**New Start**

## Pursuing a Good Idea

The Transportation Research Board (TRB) Innovations Deserving Exploratory Analysis (IDEA) Program provides start-up funding for promising but unproven concepts that are primarily vehicle-related and exhibit the potential for innovation in surface transportation systems. IDEA differs from most government research funding programs in that proposals may be submitted for a variety of innovative projects within the general category of R&T. The purpose of this program is to provide ongoing funding for innovative projects relating to motor carrier safety and safety-enhancing technology. In FY'01, FMCSA and the Federal Railroad Administration established and jointly funded a new IDEA project called the Transportation Safety Technology IDEA Program. Both FMCSA R&T and ITS funding contribute to this program. IDEA projects will be competed and administered by TRB with the principal participation of FMCSA R&T. For additional information on the IDEA Program, visit the TRB Web site at <http://nationalacademies.org/trb>.

**Contact:** Jerry Robin  
**Product:** Preliminary recommendations for FMCSA by the IDEA Committee, FY'02





# Crosscutting Safety Initiatives

*Many safety issues are crosscutting in that they involve significant aspects of vehicle safety, driver safety, and carrier safety, as well as the environment in which they operate.*

Many FMCSA R&T activities are crosscutting in that they support the overall R&T Program—either its knowledge base or the tools available to enhance its effectiveness. In another sense, many safety issues are crosscutting because they involve significant aspects of vehicle safety, driver safety, and carrier safety, as well as the environment in which they operate. Crosscutting R&T activities are planned over the next decade to:

## **Goals**

- gain a deeper and broader understanding of driver, carrier, vehicle, and roadway factors that place commercial motor vehicles at risk
- determine the potential applicability of countermeasures
- provide program support to all R&T Program areas
- achieve a better understanding of CMV crash characteristics, causes, precursors, risk factors, and potential applicability of countermeasures
- address specific crash problems and assess potential countermeasures relevant to CMV safety (encompassing

- regulation/enforcement, education/outreach, safety management practices, and technology)
- identify gaps in our understanding of CMV crashes and in Agency programs to address them
- form and foster R&T partnerships within the motor carrier safety community
- continuously improve administrative, management, and media support to FMCSA R&T, customer outreach, and program evaluation

The Crosscutting Safety Initiatives Program Area also includes projects to support FMCSA R&T and to respond to issues not otherwise addressed in the R&T Program. The common theme in these studies is that they support the overall R&T Program by increasing its knowledge base. These studies also engage the Agency's research partners to improve the effectiveness of the organization in reaching its customers and attaining its goal of reducing the number of fatalities and injuries resulting from crashes involving large trucks by 50 percent by 2010.

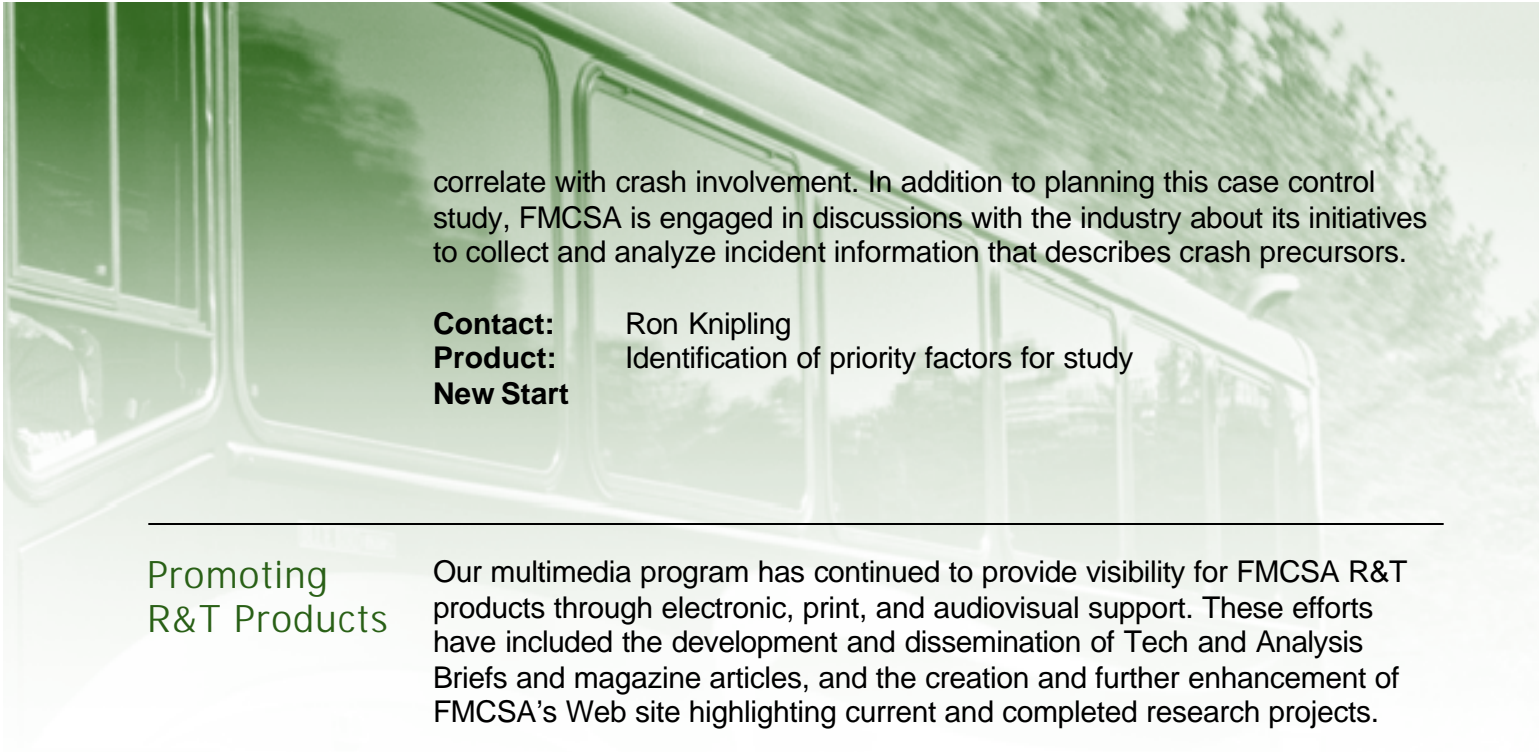
The following descriptions highlight projects that are representative of both new starts and continuing work performed in FY'01 in this program area.

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## Assessing Risk Factors

This study complements the FMCSA crash causation study by determining the relative crash risk associated with driver characteristics (age, years of experience, training, violations, crash history), physical/medical qualifications (vision, hearing, diabetes, epilepsy, sleep apnea), driving performance characteristics (measurements of driving performance taken by in-vehicle black boxes, in simulators, or using both), and schedule factors (work schedule, time of day, time on task, sleep, and rest). The study will compare the characteristics and performance correlates of drivers who have been involved in crashes to a control group of drivers who have not been involved in crashes. Most likely, both groups studied will work within a single large fleet. Diagnostic testing batteries will be used to determine potential selection factors for overall driving safety performance and, specifically, for driver susceptibility to fatigue. Such psychometric/behavioral data could be used to enable commercial trucking fleets to make better hiring choices. The same study will also gather data on vehicle factors (vehicle age, design features) and highway/environmental factors (type of roadway, weather) that





correlate with crash involvement. In addition to planning this case control study, FMCSA is engaged in discussions with the industry about its initiatives to collect and analyze incident information that describes crash precursors.

**Contact:** Ron Knipling  
**Product:** Identification of priority factors for study  
**New Start**

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### Promoting R&T Products

Our multimedia program has continued to provide visibility for FMCSA R&T products through electronic, print, and audiovisual support. These efforts have included the development and dissemination of Tech and Analysis Briefs and magazine articles, and the creation and further enhancement of FMCSA's Web site highlighting current and completed research projects.

FMCSA also has initiated a comprehensive program of electronic publication of R&T reports. Aiming to expand its partnerships within and outside DOT, FMCSA has increased efforts to disseminate our research findings. Toward this goal, FMCSA invested in electronic publication, emulating the successful approaches of the ITS Program and other DOT offices. A similar support effort has continued to provide R&T information management services, such as the maintenance of standardized project information, analysis of FMCSA R&T investments, and budget tracking.

**Contact:** Zeborah English  
**Product:** Tech Briefs and Analysis Briefs on FMCSA R&T projects are available in both hard copy and on the FMCSA Web site—[www.fmcsa.dot.gov](http://www.fmcsa.dot.gov).

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### Summarizing Current Knowledge

This new program is administered by TRB and conducted by its National Cooperative Highway Research Program (NCHRP). Initial funding will support the establishment and operation of a panel to select three to four synthesis topics annually, as well as smaller panels to select researchers to perform the syntheses and to monitor progress. The synthesis reports will summarize current knowledge and the state of the practice relating to various truck and bus safety issues and interventions. The new TRB Task Force on Truck & Bus Safety Research (A3B57) will be one source of panel members to select and oversee the synthesis projects.

**Contact:** Albert Alvarez  
**Product:** Synthesis reports on specific truck and bus safety research and technology topics  
**New Start**





## Supporting the R&T Mission

A core Agency agreement with TRB was established in FY'01 to provide basic membership, ex-officio representation, participation in annual meetings, support for Agency-related committees, and other standard TRB activities in support of the FMCSA mission.

FMCSA initiated an agreement with TRB to conduct and coordinate an annual workshop on motor carrier research and technology. The first workshop was held during the annual TRB meeting in January 2001. At this workshop, FMCSA described the Agency's program areas and the overall FMCSA program to an audience comprised of members of the TRB community. TRB coordinates these annual workshops and prepares a summary of feedback received from attendees, which is forwarded to FMCSA R&T to use in its future research efforts.

**Contact:** Albert Alvarez  
**Product:** *FMCSA Research and Technology Workshop, January 2001*  
(Workshop Brief), November 2001

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## Studying Light Vehicle– Heavy Vehicle Interaction

Fifty-nine percent of the large trucks involved in fatal crashes in 1997 collided with a passenger vehicle (car, light truck) in those crashes. This real-world study complements NHTSA's crash causation study by characterizing the nature of car–truck interactions (e.g., how much headway do cars allow when passing a truck?) and providing data on the number and type of actual observed “near misses” that occur between light vehicles and trucks.

In this project, researchers instrumented several short-haul and long-haul trucks with inconspicuous video cameras and critical incident (e.g., hard steering, hard braking) sensors to record and document the actions of vehicles traveling around trucks. In particular, researchers examined passing and lane-change behavior. Intended as a proof-of-concept initiative, the study demonstrated the value and efficacy of this real-world approach to collecting near-miss driving behavior data. FMCSA is considering future larger scale studies to investigate the basis for traffic enforcement initiatives relating to car–truck proximity and interaction. These studies would likely produce examples of unsafe driver behaviors that could be used in outreach programs to improve highway space management by car and truck drivers.

**Contact:** Bob Carroll  
**Product:** *Light Vehicle–Heavy Vehicle Interaction* (Report), 2002





## CROSSCUTTING STUDIES ADVANCE THE FMCSA KNOWLEDGE BASE

Crosscutting studies identify and quantify crash risk factors and precursors (critical events preceding crashes) analytically or through direct observation to complement data available from crash investigation and reconstruction. Risk factors and precursors identified through these studies are especially relevant to commercial driver safety R&T and countermeasures. For example, this program area will provide rich and useful data on driver traits (physical and psychological) in relation to crash involvement. These studies also will provide crash genesis data relating to selected vehicle, carrier, and roadway factors. As factors are identified and quantified, each R&T and operational program area will be re-examined to ensure that the program addresses these crash factors. For example, these studies will generate research hypotheses on specific driver traits or driving behaviors relevant to crashes. They also will generate new and extensive safety knowledge that can be incorporated into projects to educate the motor carrier industry on effective safety practices.

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### Identifying the Most Dangerous Travel Hours

Is truck travel more dangerous during the overnight hours of midnight to 6:00 a.m. when vision is hampered by darkness, driver fatigue is expected, and alcohol-impaired passenger vehicle drivers are more prevalent on our Nation's roads? FMCSA investigated this hypothesis by determining the time of day during which the rate of fatal tractor-trailer crashes per mile was highest. To accomplish this task, researchers obtained fatal crash data for tractor trailers by hour-of-day, established measures of tractor-trailer activity (in miles traveled) by hour-of-day, derived the fatal crash rate for tractor trailers by hour-of-day, examined the crash rates for trends over each 24-hour period to establish whether the rate is different for overnight travel than for the rest of the day, and performed consistency checks to assess the reliability of the data.

Surprisingly, the analysis indicated that the fatal crash rate for tractor trailers is roughly constant over the whole day with no discernible trends or

differences among various time periods. In contrast, a comparable analysis of the fatal crash rate for passenger cars and light trucks revealed sharp increases after midnight and a peak at 3:00 a.m.

**Contact:** Ron Knipling  
**Product:** *Fatal Crash Rates for Tractor-Trailers by Time-of-Day*  
(Analysis Brief), 2002

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### Determining the Causes of Hazardous Materials Incidents

In FY'01, FMCSA initiated a 6-month pilot project, similar to the Trucks in Fatal Accidents Program, to determine the feasibility of gathering more in-depth information about hazardous materials incidents and crashes. This information will be used to analyze the causes and effects of serious hazardous materials incidents and crashes, with an emphasis on cargo tank motor vehicle failures and crashworthiness. The objective of the project is to lower the risk of hazardous materials transportation by identifying and focusing resources on areas that cause safety problems. If this effort is deemed feasible, FMCSA would then conduct a 1-year study of these events every other year.

**Contact:** Bill Byrd  
**Product:** *Hazardous Materials Incidents and Crashes* (Report), 2003



# Staying Current— Collaboration, Communication, and Conference Sponsorship

*We believe that much can be learned from our colleagues and constituents, including those from international motor carrier safety communities.*

R&T provides FMCSA with the solid research and advances in technology that the Agency requires to be the leader in truck and bus safety. As such, FMCSA sets the standard of excellence among government agencies while promoting safety, innovation, and performance. R&T staff share this vision of being a world-class leader in truck and bus safety. To implement this vision, we seek to cooperate and form mutually beneficial partnerships with other organizations, facilitate the innovative work of others that will advance national interests, place increasing emphasis on education and learning that leads to results in our work, and encourage and support our partners to assume similar leadership roles.

FMCSA R&T canvasses the motor carrier safety community to gather information on current perceptions, potential problems, and trends. Frequent contact and discussions are held with Congress and congressional staff, NTSB, and safety advocacy groups; the national enforcement community; motor carrier industry representatives; commercial driver groups; the driver

## R&T NETWORK OF PARTNER ORGANIZATIONS

This listing provides a cross-section of the many organizations the Office of Research and Technology works with on a continuing basis. It is not intended as a comprehensive listing of all the organizations that this Office includes in its network, rather as a representative sampling.

### COMMERCIAL DRIVER TRAINING

Association of Publicly-Funded Truck Driving Schools  
Driver Training and Development Alliance

### HAZARDOUS MATERIALS

National Tank Truck Carriers, Inc.

### INSTITUTIONS OF HIGHER LEARNING

Bates Technical College  
California State University  
Chippewa Valley Technical College  
Florida A&M University  
Florida State University  
Pennsylvania State University  
South Carolina State University  
West Virginia University

### INSURANCE

Insurance Institute for Highway Safety

### INTERNATIONAL STAKEHOLDERS

Alberta Fleet Maintenance Supervisors Association  
Atlantic Provinces Trucking Association  
Canadian Council of Motor Transport Administrators  
Petroleum Services Association of Canada

### MOTOR CARRIER INDUSTRY

American Trucking Associations  
Independent Truckers and Drivers Association  
National Association of Truck Stop Operators  
National Private Truck Council  
Owner-Operator Independent Drivers Association  
Transport International Pool, Inc.

### MOTORCOACH INDUSTRY

American Bus Association  
United Motorcoach Association

### NATIONAL ENFORCEMENT

Association of Accident Reconstruction Specialists  
Commercial Vehicle Safety Alliance  
Pennsylvania Traffic Institute for Police Services

### SAFETY ADVOCACY

Advocates for Highway and Automobile Safety  
Citizens for Reliable and Safe Highways  
Parents Against Tired Truckers

### SCIENCE & TECHNOLOGY

American Museum of Science and Technology  
American National Standards Institute  
Institute of Electrical and Electronics Engineers  
Institute of Transportation Engineers  
Intelligent Transportation Society of America  
The Johns Hopkins University Applied Physics Laboratory  
Oak Ridge National Laboratory  
Society of Automotive Engineers

### SHARING SAFETY TECHNOLOGIES: DOT

Federal Aviation Administration  
Federal Highway Administration  
Federal Railroad Administration  
Federal Transit Administration  
Maritime Administration  
National Highway Traffic Safety Administration  
Office of the Secretary of Transportation  
Research and Special Programs Administration  
Saint Lawrence Seaway Development Corporation  
United States Coast Guard

### SLEEP RESEARCH

National Center on Sleep Disorders Research  
National Sleep Foundation

### STAKEHOLDER ORGANIZATIONS

American Law Firm Association  
Food Distributors International  
North American Travel Monitoring Association  
North American Warehousing & Distributors Association  
Port Authority of New York and New Jersey  
United Fresh Fruit & Vegetable Association

### STATE GOVERNMENT

American Association of Motor Vehicle Administrators  
American Association of State Highway & Transportation Officials  
International Fuel Tax Association, Inc.  
International Registration Plan, Inc.  
Interstate 95 Corridor Coalition  
National Governors Association

### VEHICLE MANUFACTURERS

Truck Trailers Manufacturers Association  
Design Build Manufacturers Association



training community; sleep researchers and activists; insurance representatives; truck manufacturers; and the motorcoach industry.

FMCSA R&T consults and collaborates within the DOT with highway safety researchers such as those at the FHWA Turner–Fairbank Highway Research Center, heavy vehicle design researchers from the NHTSA Office of Vehicle Safety Research, and other specialists from DOT modal administrations. In particular, FMCSA collaborative efforts are aided by the DOT Safety Council, Human Factors Coordinating Committee, and related “One DOT” activities.

FMCSA R&T chairs the TRB Truck and Bus Safety Research Subcommittee, an important means of communication with the academic community. FMCSA co-sponsors and actively participates in a wide range of conferences, symposia, and workshops. We believe that much can be learned from our colleagues and constituents, including those from international motor carrier safety communities. To that end, we sponsored several major conferences to promote information exchange and dissemination. Highlights of conferences sponsored by FMCSA R&T in FY’01 are provided in the following section.

***Improving Safety for Drivers and Fleets: Historical and Innovative Approaches.*** The objective of this conference, conducted by the 21<sup>st</sup> Century Driver and Truck Alliance, was to stimulate both discussion and action toward the understanding and implementation of holistic approaches to commercial driving safety—in particular approaches that emphasize the driver’s contribution to safety. Held in Pittsburgh, Pennsylvania, on June 18–19, 2001, the conference focused on developing a program that addresses a fundamental understanding of safety processes and practical approaches to improve safety in the trucking industry. Of particular interest was the ability to use advanced technologies relating to driver training, testing, safety management, and crash avoidance. Proceedings from the Conference are available by contacting Richard Grace at (412) 681-7159 or [rgrace@rec.ri.cmu.edu](mailto:rgrace@rec.ri.cmu.edu).

***International Driving Symposium on Human Factors in Driver Assessment, Training, and Vehicle Design.*** This international safety conference, conducted by the University of Iowa and co-sponsored by FMCSA R&T, provided an interdisciplinary forum for scientific exchange between experts and users. Topics included at the conference held on August 14–17, 2001, in Aspen, Colorado, included driver assessment and driver performance enhancement, as well as related tools and technologies to improve highway safety. Approximately



150 individuals attended this conference, including representatives from 16 countries. Symposium participants addressed a number of technical areas including driver performance management, instrumented vehicles, vehicle design, driver assessment tools, driving simulators, training, driver recruitment and selection, and driver health and wellness. The symposium included a technical session dedicated exclusively to commercial drivers, as well as a multi-disciplinary panel discussion designed to solicit ideas to further enhance commercial vehicle operations, commercial driver performance, and highway safety. For additional information, see the conference Web site at [www.driving-symposium.org](http://www.driving-symposium.org).

***International Driver Training and Research Conference.*** The Carnegie Mellon Driver Training and Safety Institute (CMDTSI) hosted the First Annual EuroTra (European Transport Training Association) Transatlantic Transportation Safety Summit in Uniontown, Pennsylvania, on June 6–9, 2001. The purpose of the conference was to address developments in commercial driver training such as the use of technology for potentially enhancing driver performance and safety. Conference attendees included Federal transportation officials and representatives of the 20 European countries that comprise EuroTra. The conference provided an international exchange of information to enhance driver training, performance, and safety.



# List of Acronyms

CDLIS	Commercial Driver Licensing Information System
CDL	commercial driver's license
CMDTISI	Carnegie Mellon Driver Training and Safety Institute
CMV	commercial motor vehicle
CVISN	Commercial Vehicle Information Systems and Networks
CVO	Commercial Vehicle Operations
CR	Compliance Review
DOT	United States Department of Transportation
EDI	electronic data interchange
EEG	electroencephalograph
EuroTra	European Transport Training Association
FHWA-OMC	Federal Highway Administration Office of Motor Carriers
FMCSA	Federal Motor Carrier Safety Administration
FMCSRs	Federal Motor Carrier Safety Regulations
FY	Fiscal Year
HMPIP	Hazardous Materials Package Inspection Program
IDEA	Innovations Deserving Exploratory Analysis
ITS	Intelligent Transportation Systems
IVI	Intelligent Vehicle Initiative
MCSIA	Motor Carrier Safety Improvement Act of 1999
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PERCLOS	PERcent of eyelid CLOSure
R&T	Research and Technology Program
SBIR	Small Business Innovation Research
SimVal	simulator validation
TEA-21	Transportation Equity Act for the 21st Century
TRB	Transportation Research Board
TST	Transportation Safety Technology

## Tech Briefs and Analysis Briefs Published in 2001

The following documents are available on the FMCSA Web site at [www.fmcsa.dot.gov](http://www.fmcsa.dot.gov).

*Qualifying Individuals with Insulin-Treated Diabetes to Operate Commercial Motor Vehicles*  
Tech Brief, November 2001, FMCSA-MCRT-02-001

*FMCSA Research and Technology Workshop January 2001*  
Workshop Brief, November 2001

*Drug and Alcohol Testing Survey—1999 Results*  
Analysis Brief, August 2001, FMCSA-MCRT-01-008

*Visual Requirements for Commercial Motor Vehicle Drivers*  
Tech Brief, June 2001, FMCSA-MCRT-01-007

*Impact of Local/Short-Haul Operations on Driver Fatigue*  
Tech Brief, May 2001, FMCSA-MCRT-01-006

*Cost of Large Truck- and Bus-Involved Crashes*  
Analysis Brief, March 2001, FMCSA-MCRT-01-005

*Bus Driver Fatigue and Stress Issues Study*  
Tech Brief, February 2001, FMCSA-MCRT-01-004

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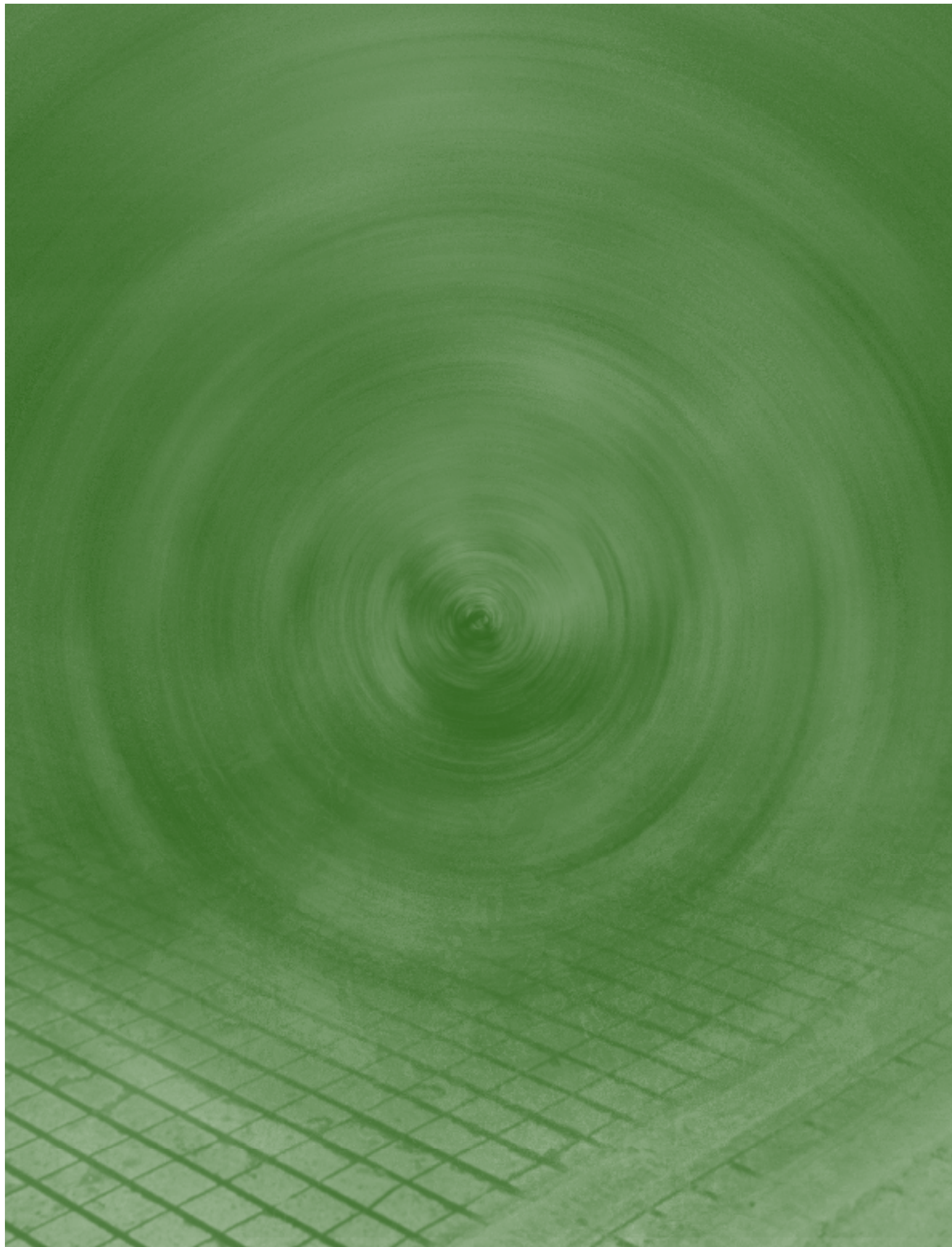
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